

Monitoring and Assessment

Water Quality Standards Academy

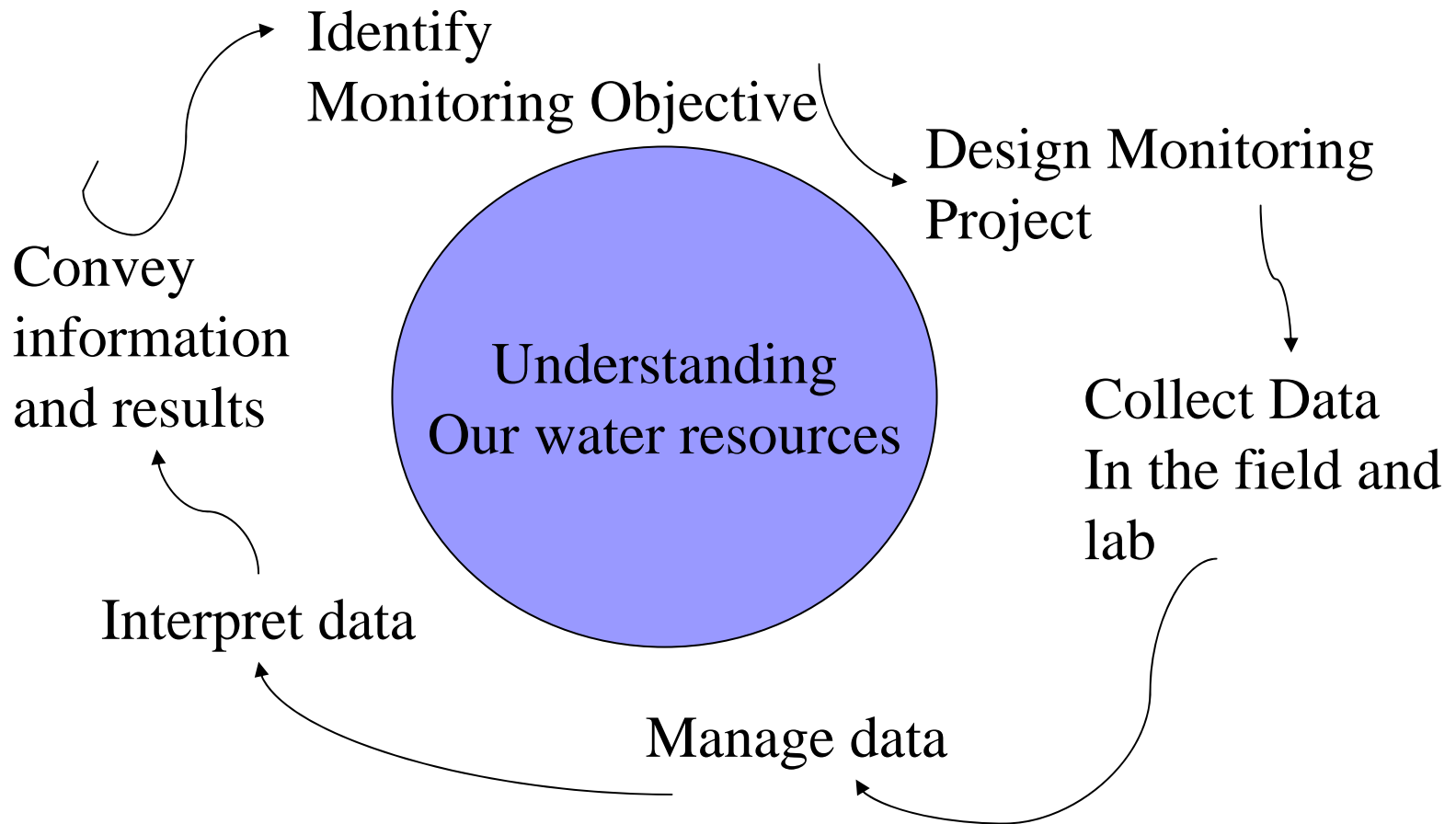
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EPA Region 10



What does this session cover?

- Monitoring Framework
- What are the monitoring objectives and information needs
- What should be monitored
- Tools for monitoring and assessment
- Reporting on water quality

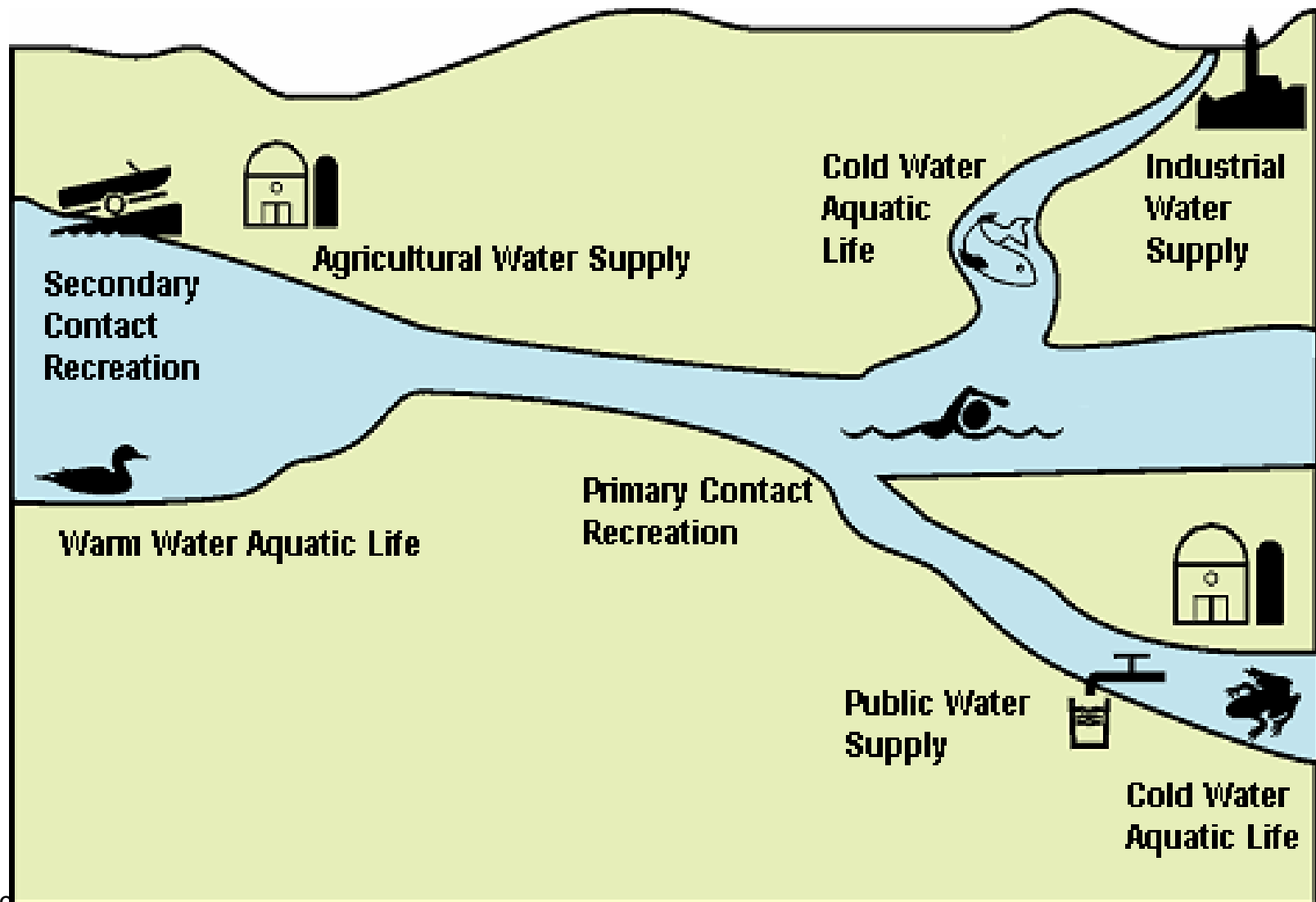
Monitoring Framework



Identify Monitoring Objectives

- What question(s) does your management, tribal council, the public or your boss want the study/project/program to answer?
- Don't start with what to measure in the field. Monitoring objectives are broader, things like....
 - Are the streams healthy? What is the condition of waters entering / leaving the reservation?
 - Are the fish safe to eat?
 - Is this restoration project working?
 - Monitoring objectives often focus on Uses.
- If there isn't anyone out there providing this input, then try to guess what you think that they might ask.

Designated Uses:

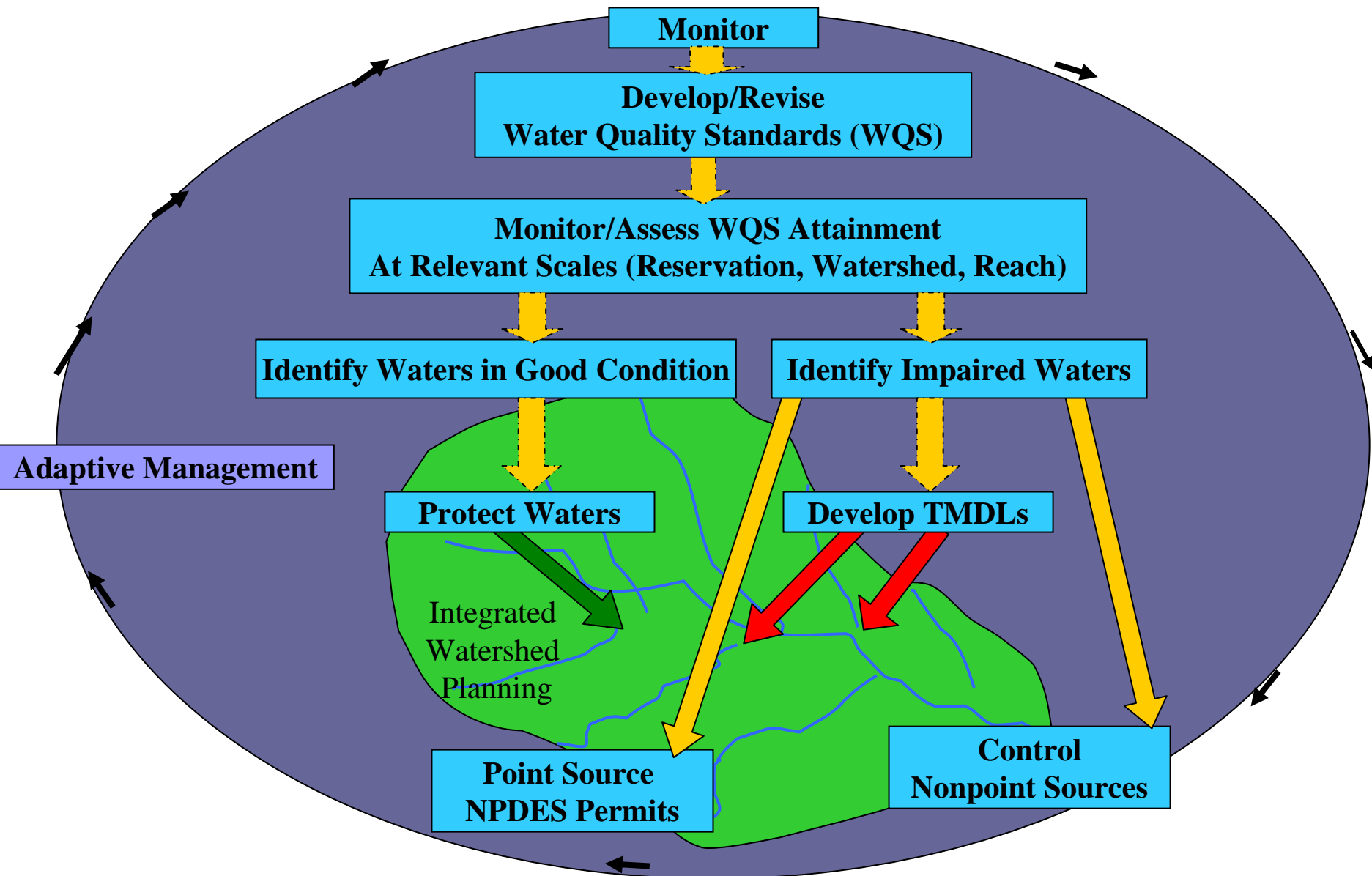


Some of the Water Quality Information needs under the CWA

303	Establish WQS for all waters
305(b)	Report water quality status for <u>all</u> waters
303(d)	<ol style="list-style-type: none">1. Submit prioritized list of waters that do not meet WQS and need a TMDL2. Develop TMDL
402	Issue permits to point sources to meet WQS
319	Manage nonpoint sources to meet WQS
309	Ensure point source compliance with permits

Monitoring Objectives	Scale
1) Assess a specific water quality improvement project	Stream reach scale
2) Identifying healthy and degraded streams within a watershed	Watershed scale
3) Determine baseline condition on the reservation 4) Evaluate water quality trends on the reservation	Reservation wide

Monitoring Supports Sound Decisions



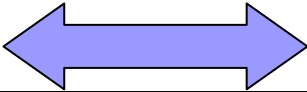
Design Monitoring Project or Program

- Take the broader Monitoring Objectives and translate them into specific monitoring goals.
- These goals are expressed as questions that specify what needs to be measured (or modeled or assessed in some way).
 - For example, translating “Is it safe to swim in the stream?” to measuring pathogens, nutrients, and flow.
- This is also where you look at existing data (do we need to go out and collect the information ourselves?)
- This is the **who**, **what**, **how**, and **where** of monitoring.
- However, probably the biggest factor in designing your monitoring project or overall program is....



Approximate costs

Costs per site (planning to reporting):

<u>\$1000/site</u>		<u>\$5000/site</u>
<ul style="list-style-type: none">- Seasonal employees- 2 person field crews- Consumables- Sites close-by, easy access- Simple reporting	Plus	<ul style="list-style-type: none">- Permanent Staff- 3 to 4 person field crews- Consumables + equipment- Remote sites, difficult access- Glossy reporting

Lab costs (per sample):

Water (Conventionals): \$70 to \$150

Water (Metals): \$25 to \$115

Water (Priority pollutants): \$100 to \$200

Water (Pathogens): \$20 to \$50

Fish Tissue Contaminants: \$150 to \$1500

Macroinvertebrates (identification & counting): \$150 to \$350



Who Monitors Water Quality?

- States and Tribes implement monitoring programs under CWA 106
- Federal agencies monitor to support their management and research needs
- Volunteer and citizen groups monitor to understand local conditions
- Other organizations include local government, academic organizations...

What Should Be Monitored?

- Select core indicators appropriate for assessing attainment with designated uses
 - ☐ Aquatic life
 - ☐ Recreation
 - ☐ Public water supply
 - ☐ Fish and shellfish consumption
- Identify supplemental indicators as needed
 - ☐ Address potential problems in watersheds
 - ☐ Identify causes of biological impairment
 - ☐ Investigate emerging concerns

What - Core and Supplemental Indicators to Assess WQS Attainment

	Aquatic Life	Recreation	Drinking Water	Fish / Shellfish
C O R E	Biological communities Basic chemistry(e.g. DO, pH) Nutrients Flow Habitat assessment Landscape condition	Pathogen indicators (<i>E. coli</i> , enterococci) Nuisance plant growth Nutrients Chlorophyll Flow Landscape condition	Trace metals Pathogens Nitrates Salinity Sediments/TDS Flow Landscape condition	Pathogens Mercury Chlordane DDT PCBs Landscape condition
O T H E R	Ambient toxicity Sediment toxicity Other chemicals of concern in water or sediment Health of organisms	Other chemicals of concern in water or sediment Hazardous chemicals Aesthetics	Other chemicals of concern in water or sediment VOCs (in reservoirs) Hydrophyllic pesticides Algae	Other chemicals of concern in water or sediment

How? – Protocols, field methods, laboratory methods, etc.

1. Chemistry – Usually well documented field and lab methods
 - Field methods – different levels for different questions. From Volunteer methods to chain of custody/enforcement methods.
 - Lab – also different levels
 - For more information on water column chemistry methods - contact USGS, EPA, state environmental/health agencies

How? – Continued

2. Biology – Usually well documented, sometimes generally accepted field and lab methods (depends on the waterbody type...i.e. lakes, streams, wetlands, etc.).

- Field – Again different levels for different questions.
- Lab – also different levels.
- For more information contact EPA or State.

2. Habitat – Usually well documented, sometimes generally accepted field methods (depends on the waterbody type...i.e. lakes, streams, wetlands, etc. and the geographic location.)

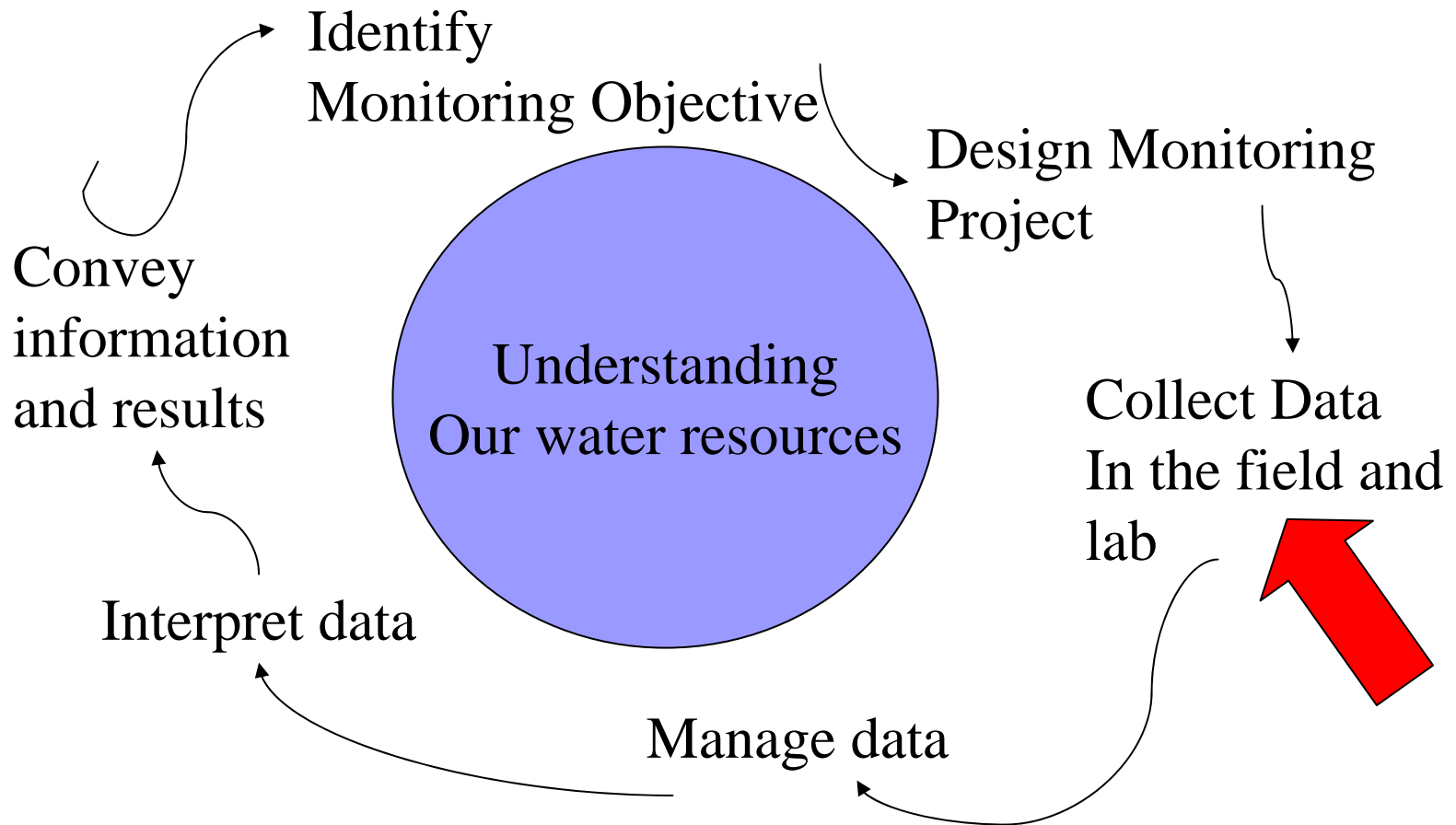
- Field – Again different levels for different questions.
- For more information contact EPA, Federal Land Management agency, or State.

Where? *Monitoring Design*

- Depends on your question!
 - Site specific
 - Area wide
 - Upstream/downstream
 - Paired watershed

Monitoring Design	Types of questions they can answer
Statistically-valid survey	<ul style="list-style-type: none"> ■ Predict proportion of all waters in good or poor condition ■ Measure broad-scale water quality trends ■ Prioritize targeted monitoring
Modeling and landscape analysis	<ul style="list-style-type: none"> ■ Determine where water quality is likely impaired ■ Predict water quality trends ■ Prioritize targeted monitoring
Targeted monitoring	<ul style="list-style-type: none"> ■ Assess WQS attainment for specific segments ■ Measure localized water quality trends ■ Identify sources of pollutants to specific waters ■ Support development of local management measures (TMDL, NPDES permits, NPS BMPs, WQS) ■ Assess performance of management measures

Monitoring Framework





Before
you go out in
the field....

You need to
develop a Quality
Assurance
Project Plan
(QAPP)

United States
Environmental Protection
Agency

Office of Wetlands,
Oceans and Watersheds
4503F

EPA 841-B-96-003
September 1996



The Volunteer Monitor's Guide To

Quality Assurance Project Plans

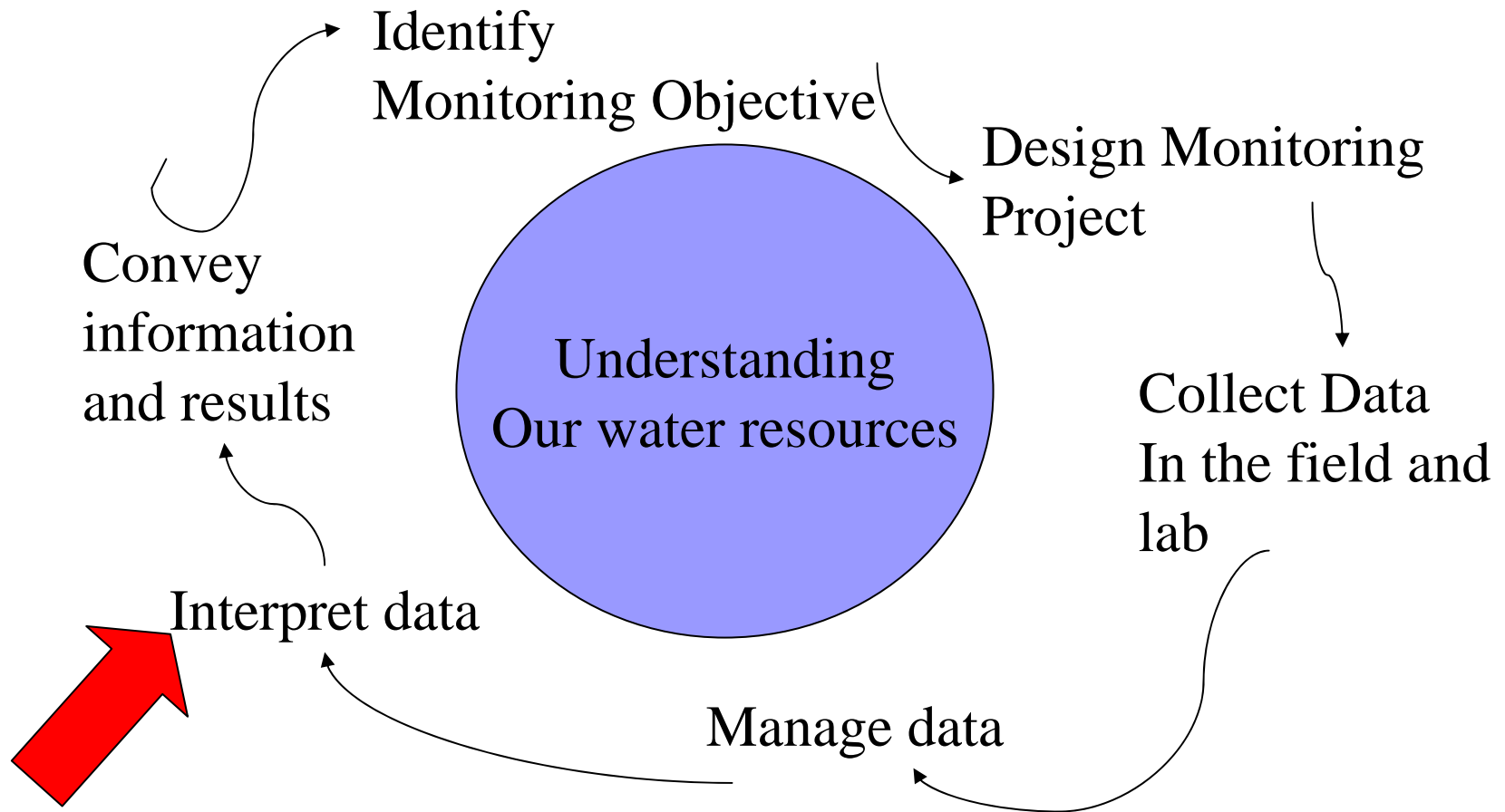




Managing Data

- Determine what you are going to use to manage data at your desk
 - Spreadsheets work fine, unless you have a large volume of data
- EPA's STORET data storage and retrieval
 - Free oracle database and user support to share and archive data
 - New warehouse provides quick access to data of documented quality (www.epa.gov/storet)
 - Hint – make sure that your contract Lab sends you data in a STORET ready format
- GIS supports data analysis and interpretation
 - Record sampling locations (Lat./long., stream name)
 - National Hydrography Dataset

Monitoring Framework



What data do you have?

And how do you turn it into an assessment?

Example:

Aquatic Life	Recreation
Dissolved Oxygen	E. coli
pH	
Temperature	
Macroinvertebrates	

What Water Quality Criteria can be applied?

- Narrative or numeric expressions of parameters designed to protect designated uses (such as temperature, pH, toxics).
- Another type of criteria is biological criteria which are numeric or narrative expressions that describe the "desired" aquatic communities inhabiting a waterbody.



What if there are no Water Quality Criteria?

Criteria?

- In our example, there are numeric criteria for dissolved oxygen, pH temperature and e. coli.
- However, there are no biological criteria for macroinvertebrates.
- This is where an Assessment Methodology comes in (for both those indicators with numeric/narrative criteria and those without criteria, but that are relevant to Uses).



Assessment Methodology

- Describe the hierarchy of indicators and tools used to assess water quality
- Document procedures
 - For collecting and reviewing all readily available and existing data and information
 - For making WQS attainment decisions for all applicable criteria
 - Address numeric criteria, narrative criteria, and designated uses
 - Define data quality and documentation needs
 - Describe analytical approaches for interpreting data and information

Developing An Assessment Methodology

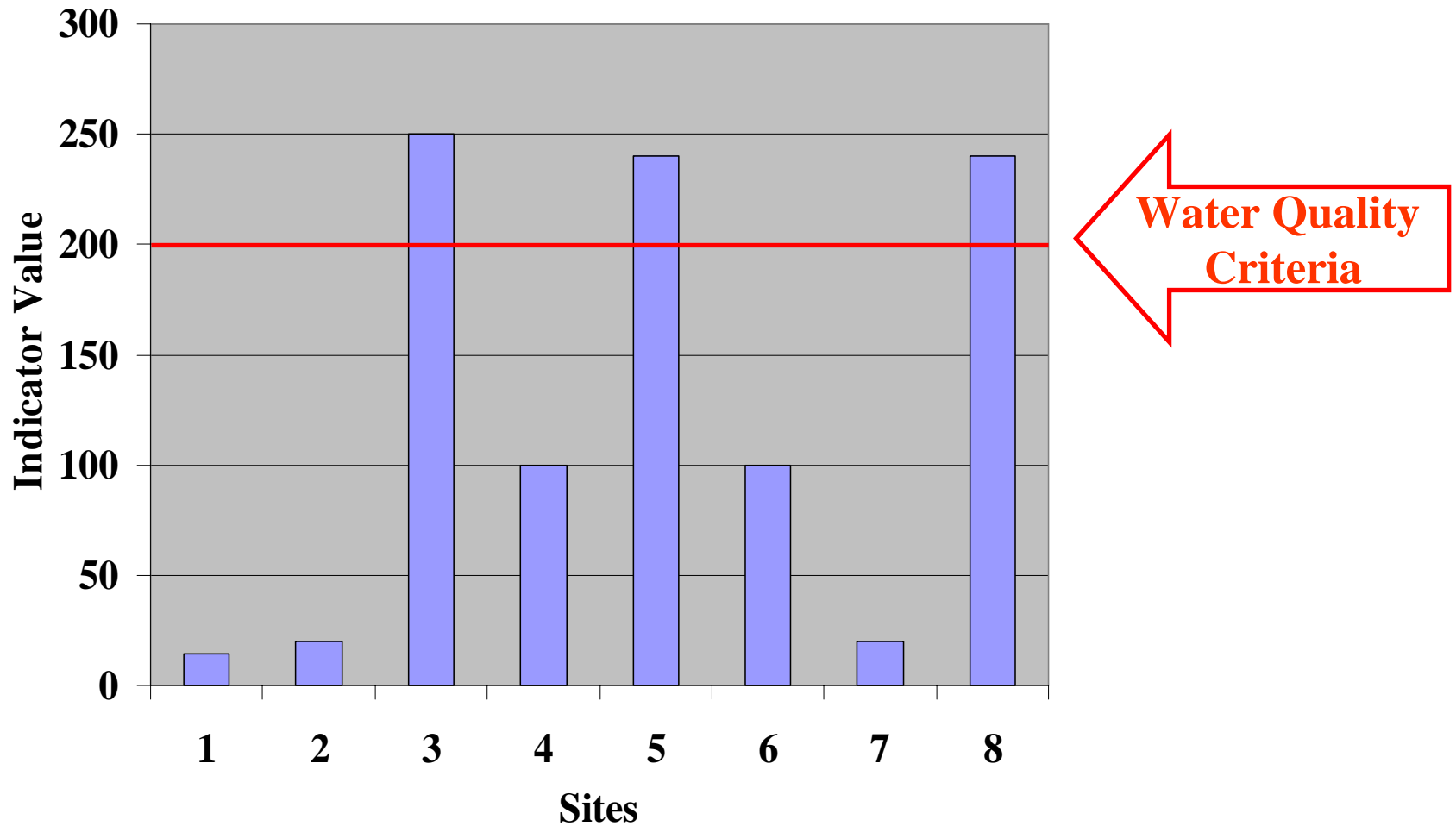
Things to Consider:

- Magnitude and duration of an exceedances
- Age of data
- Number of data points – more sites vs. more frequency
- Data quality
- Multiple data types
- Define what is “healthy”

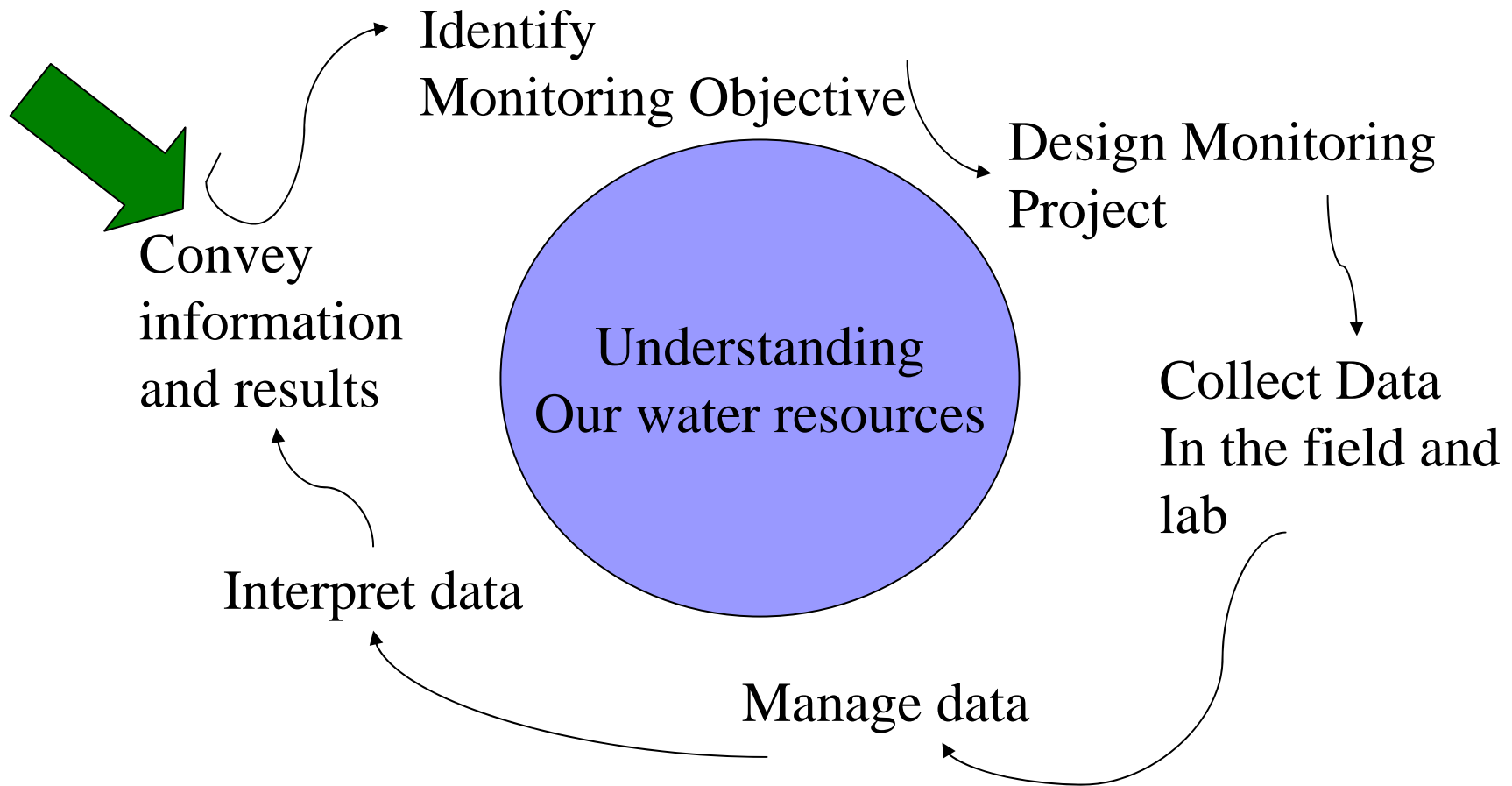
Interpreting WQS:

- Number of exceedances (e.g. 10% for conventionals)
- Age of data (e.g. less than 5 years old for conventionals, habitat and biological, less than 10 years old for toxics)
- What biological/habitat data will be used? (e.g. it must be collected with a certain protocol, during an index period and identified to genus)
- For parameters without numeric criteria, what is “degraded” (e.g. an Benthic Index score of 48)?
- Data must have been collected under an approved QAPP?

Magnitude and Frequency



Monitoring Framework

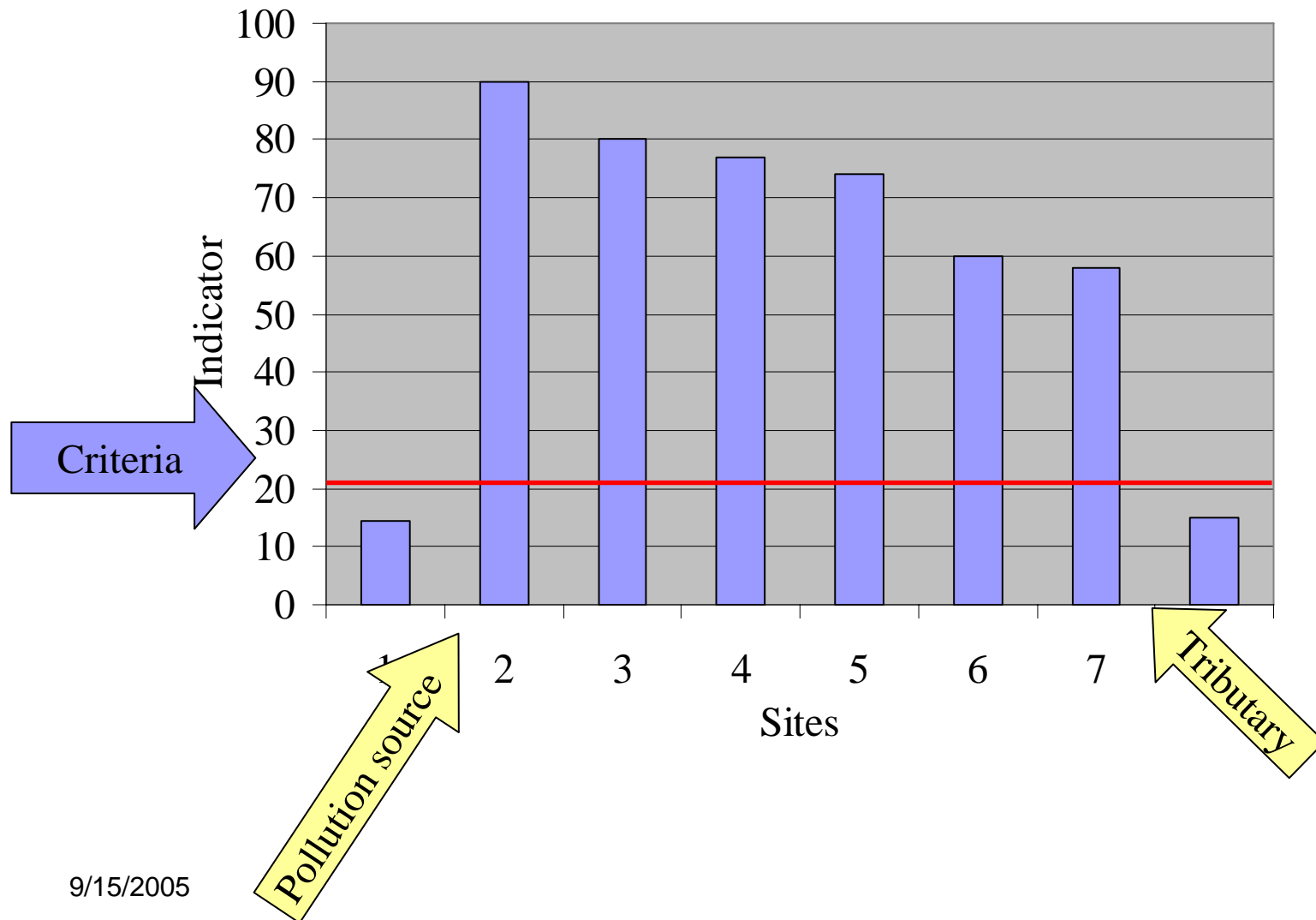




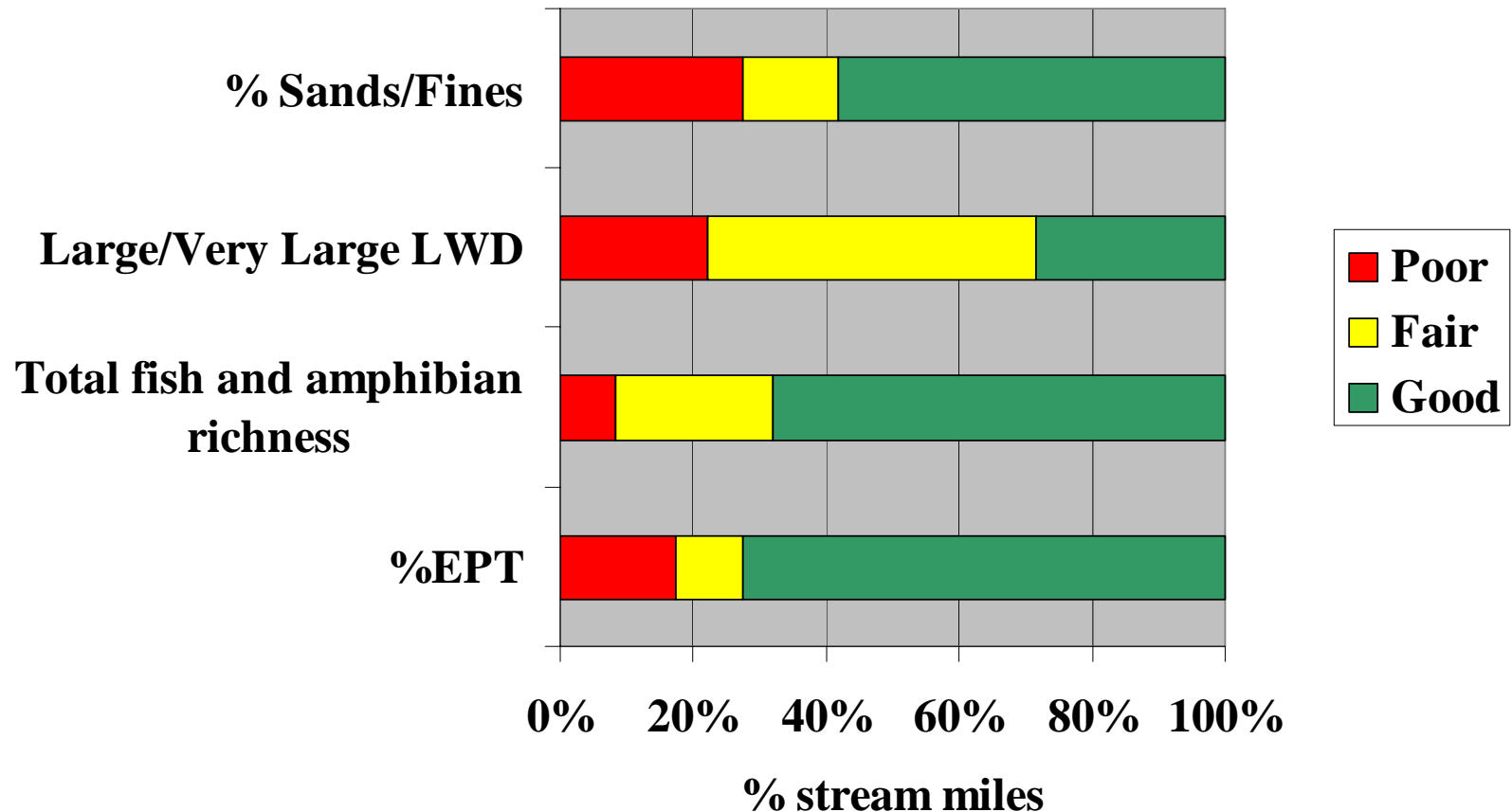
Communicating Results

- Summary the information, not the numbers
- Use oral presentations and written documents to communicate results
- Via presentations to Council, NPS reports, newspaper articles, etc.

Reporting Upstream / Downstream data



Reporting Probability Survey Data



Reporting on Water Quality— CWA & 1992 Regulations

- 305(b) water quality inventory report
 - ☐ Extent of all state waters that meet the goals of the CWA, including WQS attainment
 - ☐ Causes and sources contributing to impairments
- 303(d) list of waters needing TMDL
 - ☐ Impaired & threatened waters
 - ☐ Impaired by pollutants
- States required to submit every 2 years, Tribes are not required to submit either 303(d) or 305(b)
- EPA approval/disapproval of 303(d) list



Integrated Reports— EPA Policy since 2002

- Integrate CWA water quality assessments & reports
- Document assessment methodology for WQS attainment decisions
- Categorize all state waters based on WQS attainment status
- Present results of probability-based design at state or watershed scale
- Establish monitoring priorities for next 2 years
- Establish TMDL development priorities for all Category 5 waters

Integrated Report Categories

305 (b) Report

1. Attaining all designated uses
2. Attaining some designated uses, and insufficient or no data and information to determine if remaining uses are attained
3. Insufficient or no data and information to determine if the standard is attained
4. Impaired or threatened for one or more designated uses but not needing a TMDL because --
 - a. TMDL has been completed
 - b. Expected to meet standards
 - c. Not impaired by a pollutant
5. Impaired or threatened by pollutant(s) for one or more designated uses and requiring a TMDL

**303(d)
List**

Questions?

